Fe/$CuSO_4$ Stoichiometry Lab

Purpose: To explore the actual and theoretical relationships between reactant and product in chemical reactions.

Problem: Is it possible to predict the amount of product that will be produced in a reaction if you know the balanced equation for the reaction AND the amount of the reactants?

In this reaction, you will combine iron filings and copper (II) sulfate in a beaker. Conduct the experiment and compare your expected (theoretical) value with your experimental value.

Materials:

Iron filings Copper (II) Sulfate anhydrate Distilled water

Pre Lab:

1. Please write the balanced chemical equation for the reaction of iron and copper (II) sulfate.
2. Why type of reaction is this?
3. What is the mole:mole ratio of iron to copper?

Procedure

1. Identify your beaker by writing a group name & period on it. Mass the labeled beaker and record.

2. Mass out approximately 5.0 g of copper (ll) sulfate & place it in your beaker. Record the *exact* mass in the table.

3. Add 50 ml of distilled water to the crystals in the beaker. Record your observations.
Warm the solution until no solid copper sulfate crystals remain. **Do Not Boil!**

4. Calculate the mass of iron needed to produce 1.5 g copper. Mass of iron needed: _____
- Use the balanced the rxn between iron and copper (II) sulfate and molar ratio of iron to Copper metal to determine mass by stoichiometry

5. Mass out the mass of iron calculated in step 4. Record the *exact* mass in the table.

6. Slowly and carefully add the iron filings (small amounts at a time) to the solution of copper sulfate. Stir the reaction with a glass stirring rod and warm for about 3 more minutes **(do not boil)**. Then, let the beaker stand undisturbed for *at least* 10 minutes.

7. Carefully pour the liquid portion of the mixture into another collection beaker, ***leaving the solid product behind***. This process is called **decanting**. You may pour the contents of the collection beaker into the proper waste container in the hood. If metal particles remain in the discard beaker, try to transfer them to the "product" beaker by "raking" them in with the glass rod. Since the objective of this lab is to determine the amount of product formed, try to **save as much product as possible!**

8. Weigh a piece of filter paper and set up filtering apparatus. Filter out the solid left in the beaker and rinse it with DI water several times. Rinse out the entire solid from the beaker several times to get all of it into the filter paper.

9. When the solid product is "clean" place the filter paper in the drying spot in the room. Clean up your work station completely! Wash your glassware!

Day 2 *(or later the same period)*
1. Mass your completely dried filter paper and product from the previous day. Record the mass in the data table.

Data Table

Item Massed (g)	**Mass (g)**
Clean filter paper	
Copper (II) sulfate crystals	
Iron filings	
Filter paper and dry product (second day)	
Dry product alone	

Analysis

1. Show your calculation used to determine the mass of iron filings needed to produce 1.5 g Cu.
2. Determine the ratio of moles of iron actually used to moles of new product actually formed. Does this molar ratio agree with the ratio from the balanced chemical equation?
3. How many moles of $CuSO_4$ were available in this experiment?
4. How many moles of $CuSO_4$ were used up?
5. How many moles of excess $CuSO_4$ were left over?
6. Using the names of reactants and products explain what took place in this reaction.

Conclusions

7. Once you have measured the mass of copper collected from the reaction, please compare the actual mass collected to your goal of 1.5 grams.
   - **a.** Did you get 1.5 g Cu produced? More? Less?
   - **b.** What is the percent yield? ($\%_{yeild} = \frac{actual\ yeild}{theoretical\ yeild} \times 100$)
   - **c.** Why do you think this happened?